EuroDidact®

Energy meter
Type EM20

User's Manual
Version 3.21
English

Overview

EuroDidact Energy Meter Type EM20 is a microprocessor controlled instrument for measuring energy and energyconsumption. Also the EM20 measures 2 temperatures simultaneusly.

EM20 can be used as a stand-alone instrument, or in connection with a PC. Delivered with the instrument, the windows-programme can be used for remote control of the instrument, adjusting and datalogging the data from the instrument. Also delivered with the instrument is a cable for connecting the EM20 to a PC‘s serial port (COM1 or COM2).

EM20 has the following inputs:

*	Rear	10 - 240 V_{RMS} AC	Max 10 A_{RMS}	45 - 65 Hz
*	Front	0 - 30 V_{RMS} AC 0 - 42 V DC	Max 10 A_{RMS} Max 10 A_{RMS}	16 - 999 Hz.

* Two standard type-K Thermocouple-inputs.
With these the instrument measures from -100‘C to +450 ‘C.

All measurements are displayed on the 4-digit LED-display. Display reading from front or rear is selected with a push-button. Selection from the possible readings, is done with two push-buttons.

The Instrument has a logging-function.
Start of the log can be done manually, at a given time, or if a preset limit is crossed, - or if a temperature-limit is crossed (both ways). Setup can only be done via a PC.

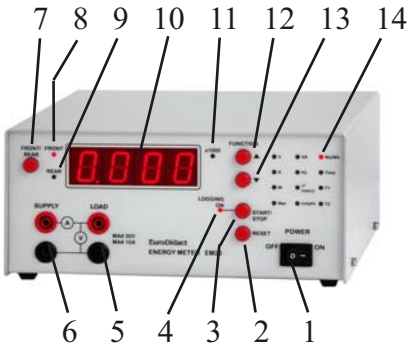
EM20 has a real-time clock that runs also without any mains power connected and the instrumnet turned off. This real-time clock is used when logging.

All data stored in the logmemory of the EM20, remains when the instrumnet is turned off and of course when the instrument is transported.

With the standard PC programme (delivered with the instrument) „EM20.EXE“, all the functions of the Energy Meter EM20 can be controlled. It is also possible to adjust the internal real-time clock, the temperature calibration, voltage and current calibration. Also the Log functions can be set, and the logged data transferred to the PC.
The Programme can display det measurementvalues in either tabel form or in graphic form
Measurementdata can be saved in/ and read from an ASCII-txt file.
At the push of a button, all measurementdata is transferred to the ‚Clip-board‘.

Description

Front:



Rear:

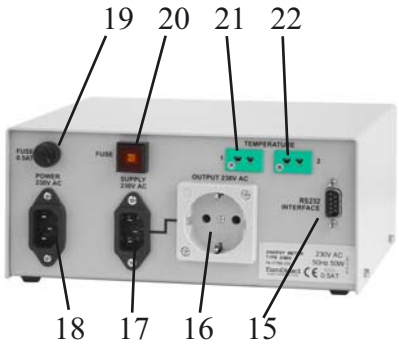


Fig. 1. Overwiev of the Energy Meter Typer EM20.

The numbers refer to Fig. 1.

FRONT PANEL

1.	POWER	On / Off button.
2.	RESET	Push-button for deleting the log and reset of Ws/Wh and Time. At the first push the ‚CLR? is displayed and at the second push, the log is reset.
3.	START/STOP	Push-button for start and stop of logging. (Starting the log also resets Ws/Wh and Time).
4.	LOGGING ON	Light Emitting Diode (LED) is constant turned on when the logging has been started. LED is flashing when log-memory is full (logging is stopped).
5.	LOAD	Connection for load on the front panel (0 - 10 A).
6.	SUPPLY	Connection for supply on the front panel (0-30V AC/0-42V DC).
7.	FRONT/REAR	Push-button for selection of measurements on the front panel or the rear panel.
8.	REAR	LED indicates that measurement on the rear panel is selected.
9.	FRONT	LED indicates that measurement on the front panel is selected.
10.	Display	4-digit LED-display.
11.	X1000	LED indicates that the display reading is to be multiplied by 1000.
12.	FUNCTION ⋀	Push-button to step backwards in list of Functions (LED indicated).
13.	FUNCTION ⋁	Push-button to step forward in list of Functions (LED indicated).
14.	Function indicator	LED‘s (12 pcs.) for indication of the selected function.

REAR PANEL

15.	RS232 INTERFACE	RS232 interface for PC.
16.	OUTPUT 230V AC	Connection of load on the rear panel (0 - 10 A).
17.	SUPPLY 230V AC	Connection of the supply on the rear panel (10 - 240V_{RMS} AC).
18.	POWER 230V AC	230V AC Mains inlet.
19.	FUSE 0,5AT	Mains fuse. (0,2 AT(preferred) or 0,5 AT(max)).
20.	FUSE 10 A	Fuse for 230 VAC outlet on the rear panel (10 A).
21.	TEMPERATURE 1	Connection of Thermocouple type K, input no. 1.
22.	TEMPERATURE 2	Connection of Thermocouple type K, input no. 2.

Instructions for use

(*Possible Updates to this User's Manual and the software can be downloaded free of charge from our website http://eurodidact.co.uk*)

The instrument is turned on with the mains-switch marked **„POWER".**

When the instrument is turned on, first the version no. i.e. **'r 1.00'** is displayed.
If one or more of the calibration values of the EM20 is outside the limit, the message **,L d d F'** (Load default) is displayed and the default values are automatically loaded. The instrument starts with the same selections as when it was shut off, and is immediately ready for use.

Voltage supply and load may be connected on the front or rear panel.
With the button **,FRONT/REAR'** the front or rear measurement is selected.

All parameters are measured and calculated every second. With the buttons **,FUNKTION A'** and **,FUNKTION V'** the parameter to be shown on the display, is selected.

Display parameters possible:

V	True RMS-Voltage	
A	True RMS-Current	
W	True Power	
VAr	Reactive Power	(Only at sinus! Calculated as: $(VA^2 - W^2)^{½}$)
VA	Apparent Power	(Only at sinus! Calculated as: $U_{RMS} * I_{RMS)}$
Hz	Frequency	
φ	Phaseangle (measured)	
COS(φ)	cos(phaseangle)	(φ-LED is flashing)
cosphi	Calculated cosphi	(Calculated as: W/VA)
Ws	Energy in Ws	
Wh	Energy in Wh	(Ws-LED is flashing)
Time	Time for Ws/Wh in seconds	
T1	Temperature 1	(From thermocouple type K sensor no. 1)
T2	Temperature 2	(From thermocouple type K sensor no. 2)

Use of the Log Function

If the instrument displayed **,L d d F'** when started, the log is set to default, i.e. all values are logged with 60 seconds interval.
Change of the log-setup is done with the PC-programme.

Logging is started and stopped again with the button **,START/STOP'.** When logging is started, the LED **,LOGGING ON'** is lit. If the log is full, the LED **'LOGGING ON'** is flashing.
At every start of the log function, the value of Ws/Wh and Time is reset to zero.

At logging means values of the measurements since last logging, are saved.

The content of the log is cleared by pressing the button **,RESET'** twice**.** The display shows **,C l r ?'**

before the second push of the button.

Display messages

In some cases the display is „text“ rather than values of measurement. The following list axplains the „text“:

Display:	**At:**	**Description:**
r x. x x	Startup	Instrument software version no., (i.e.: **r 2. 0 1)**
L d d F	Startup	Warning. Default values for voltage-, current- and temperaturemeasurements, and setup of log, are read.
- - - -	Always	If data is not available, or data is not ready.
C l r ?	Reset of log	Warning before second push at **‚RESET‘.**
F u l l	Start of log:	Warning by attempt to start the log, when this is full.
L o U	Hz	Voltage is too low for measurements (under 1.0 V). The frequency can not be measured.
H i U	V	Too high voltage (outside range).
H i A	A	Too high current (outside range).
L o F	Hz	Too low frequency (below 16 Hz).
H i F	Hz	Too high frequency (above 999 Hz).
d c	HZ	At DC.

PC programme EM20
Installation of the programme

Insert the CDROM in the drive (i.e. D:). From Windows FileManager, find the sub-folder with the EM20 s/w and run the programme <SETUP.EXE>. Use „Target“ button to select where to install the programme (typical „C:\EM20\“). Start the installation with the „Start“ button. The installationprogramme installs then the programme on the harddisk and setup a programmegroup „EuroDidact Instruments“ containing the icon „EM20“
Se Fig. 2.

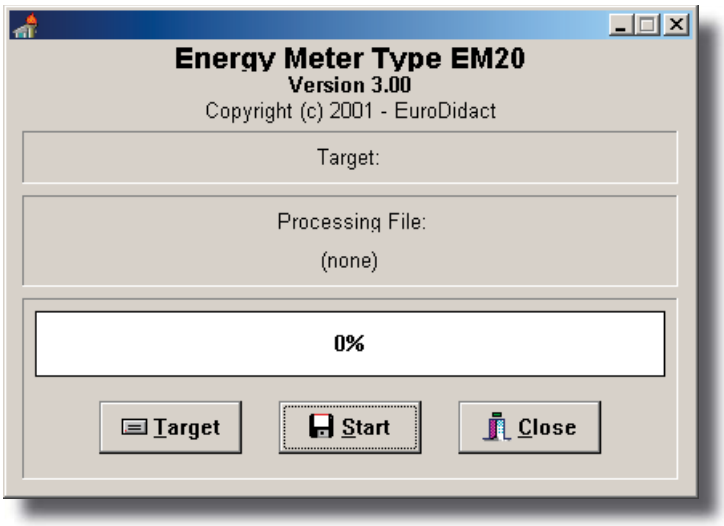


Fig. 2. Installationprogramme.

The programme is started by clicking the icon „EM20“ . When the instrument is connected correctly, the programme automatically fetches the instruments actual selections. See example below in Fig. 3.

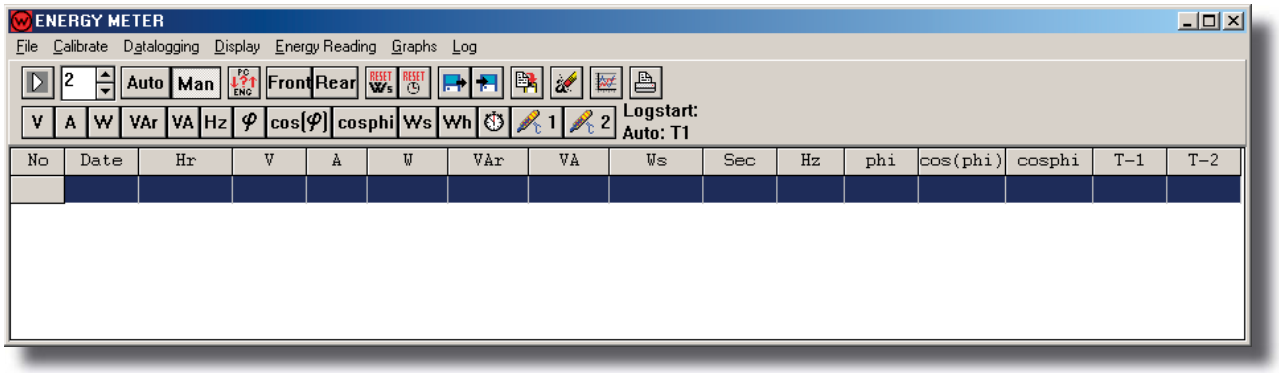
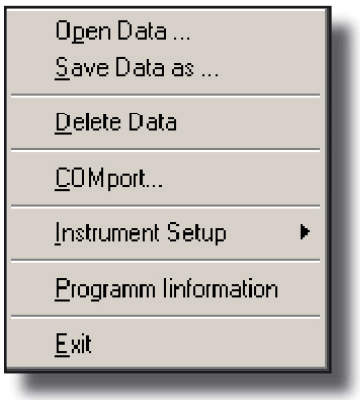

ENERGY METER
File Calibrate Datalogging Display Energy Reading Graphs Log
Auto Man Front Rear
V A W VAr VA Hz cos(φ) cosphi Ws Wh
Logstart:
Auto: T1
No Date Hr V A W VAr VA Ws Sec Hz phi cos(phi) cosphi T-1 T-2

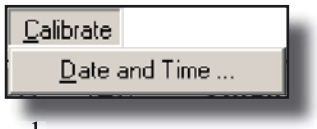
Fig. 3. Example from the programme EM20.

In the menu **„File“** the following selections are awailable:



Opens a file containing measurement data.
Saves the measurement data to a file.
Deletes measurement data from the memory.
Select the PC serial comport (COM-1 or COM-2).
Temperature reading in °C or °F , and selection of language.
Programme info. If an EM20 is connected, this instrument version is also displayed.
Exit, ends the programme.

In the menu **"Calibrate"** the following may be set::

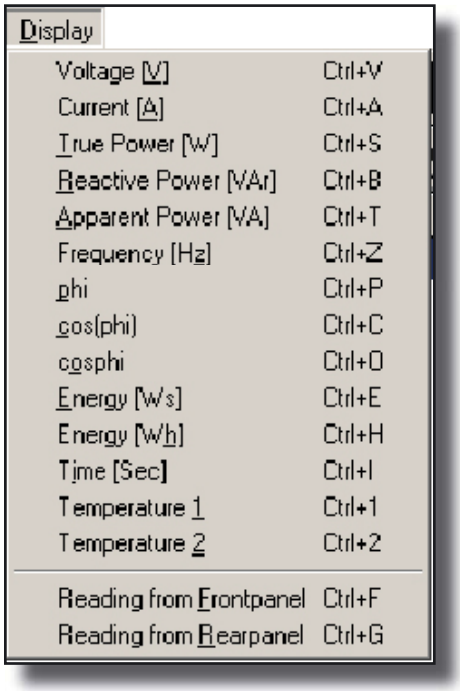


Date and time — Adjusting the real-time clock of EM20.
In the upper part date and time from EM20 is displayed.
In the lower part the date and time can be entered.

„Datalogging" menu:

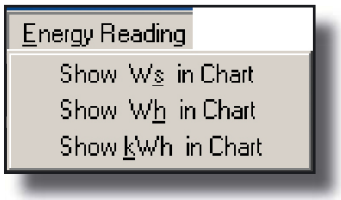
Datalogging
Automatic Datalogging from Instrument F2
Manual Datalogging from Instrument F3
Read Data from Instrument F4
Start / Stop of Automatic Datalogging Shift+F4

In the menu **„Display"** the following is available:

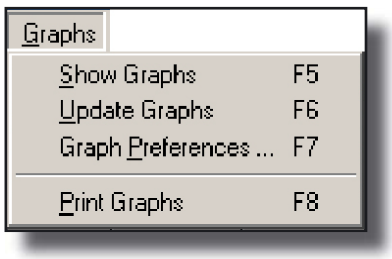


This is where to select what is displayed on the EM20 display, and if measurements are made on the front panel or on the rear panel.

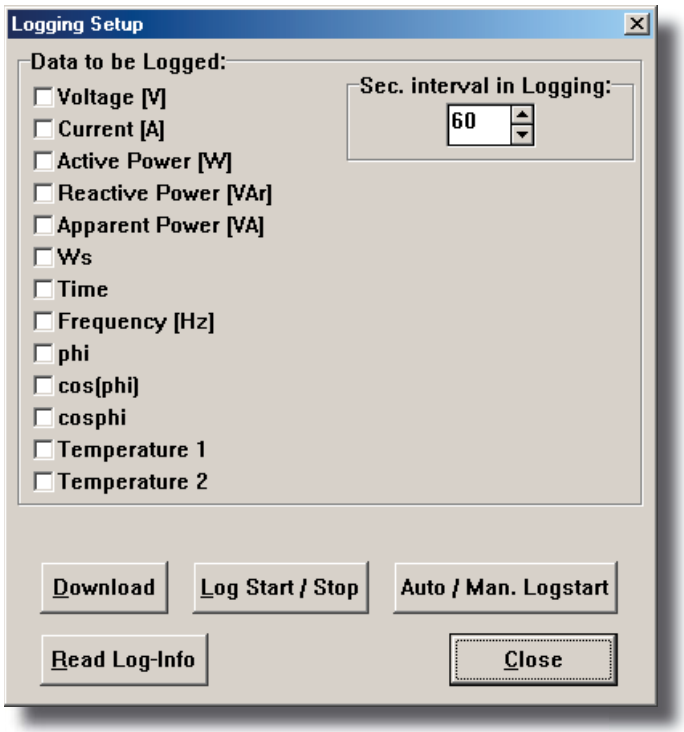
In the menu **„Energy Reading"** the following options are available:



In the menu **„Graphs"** the following options are available:



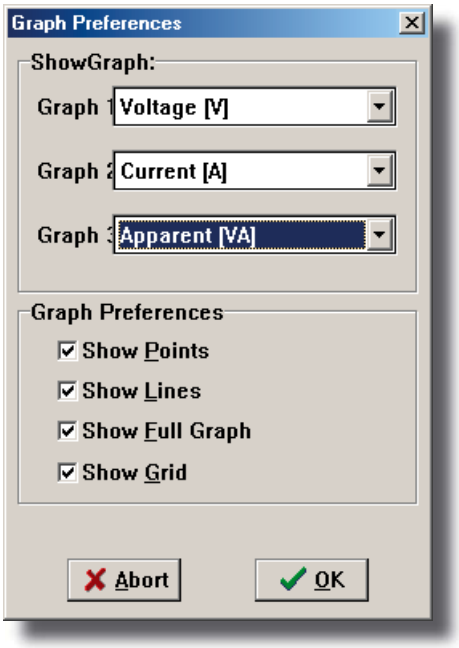
In the menu **„Log“** the following data are selectable:



Here it is possible to mark each data that is to be logged, and at what interval. The more data to log at each interval, - the fewer „log-lines“ are possible. For maximum number of intervals („log-lines“), select only the data that is necessary.
The maximum number of log-lines and the maximum logging-time is calculated and displayed.
Automatic or manual logging is set here.
After logging is finished, the data are transferred from the EM20 using this window.

Display of Graphs

Using **Graph Preferences** or **F7,** it is possible to select display of 1, 2 or 3 graphs, how to display them (Show points, Show lines between data, Show all graph, Show grid and select the data to be shown on each graph.



Datalogging mode selection

It is possible to select one of two datasampling modes.

Automatic datalogging from EM20 — Data are collected from EM20 at an adjustable intervall (from 1 to 60 Seconds).

Manual datalogging from EM20 — Data are collected from EM20 at the push of **Read data from instrument** -button or **F4.**

The instrument always starts in **Manual datalogging from EM20.**

Technical information

Mains	230 V AC +-10% 50 Hz	
Measurements on frontpanel	**Voltage**	AC: 0 - 30 V_{RMS} (DC: 0 - 42 V)
	Resolution	0,01 / 10,1 V_{RMS}
	Accuracy	+- (1% + 1 on least significant digit)
	Current	0 - 10 A_{RMS}
	Resolution	0,01 A_{RMS}
	Accuracy	+- (1% + 1 on least significant digit)
	Frequency	DC to 1000 Hz
Measurements on rearpanel	**Voltage**	10 - 240 V_{RMS}
	Resolution	0,01 / 0,1 V_{RMS}
	Accuracy	± (1% + 1 on least significant digit)
	Current	0 - 10 A_{RMS}
	Resolution	0,01 A_{RMS}
	Accuracy	+- (1% + 1 on least significant digit)
	Frekvens	45 - 65 Hz.
General	**True Power**	2400 W
	Resolution	0,01 / 0,1 / 1 w
	Accuracy	+- (2% + 1 on least significant digit)
	I	
	Reactive Power	2400 VAr (Only true at sinus)
	Resolution	0,01 / 0,1 / 1 VAr
	Accuracy	+- (2% + 1 on least significant digit)
	Apparent Power	2400 VA (Only true at sinus)
	Resolution	0,01 / 0,1 / 1 VA
	Accuracy	+- (2% + 1 on least significant digit)
	Frequency	DC og 16 - 999 Hz
	Resolution	0,1 Hz
	Accuracy	± (1% + 1 on least significant digit)
	Phaseangle φ	0^o - +-90^o
	Resolution	$0,1^o$
	Accuracy	+- (1% + 1 on least significant digit)
	cos(φ)	0,999 - 0,000
	Resolution	0,001
	Accuracy	+- (1% + 1 on least significant digit)
	cosphi	0,999 - 0,000
	Resolution	0,001
	Accuracy	± (1% + 1 on least significant digit)
	Energy (Ws I Wh)	0,0 - 9999 x 1000 Ws / Wh
	Resolution	0,1 Ws / 0,001 Wh
	Accuracy	+- (2% + 1 on least significant digit)
	Time	0 - 9999 x 1000
	Resolution	1 sek.
	Accuracy	+- 0,1%
	Temperature 1 and 2	-100^oC - +450^oC
	Resolution	$0,1^o$C
	Accuracy	+- (1% + 1 on least significant digit)

Instructions for Calibrating (only by skilled technician)

Note: *The instrument is calibrated from the factory!*

Calibration of the temperature measurements

is done with the PC-programme (Menu **„Calibrate“ - “Temperature“**). **The temperatureerror** is adjusted for each input, untill the display is correct.
The displayed **Temperaturecorrection** is transferred to the EM20 when the indication **„Downloaded“** on the screen is green.

Calibration of date and time

is done with the PC-programme (Menu **„Calibrate“ - „Date and time“**). In the top part of the window, the actual date and time from the EM20 is shown. In the lower part, the new date and time may be entered, and transferred to the EM20 by selecting **„Download“.**

Calibration of voltage and current

This is only possible, if **‚ALLOW_CALIBRATION‘(TILLAD_KALIBRERING)** is set to **‘l‘**, in the **EM20.ini** file.

If the voltage and current is to be calibrated, the line **TILLAD_KALIBRERING** in the **EM20.ini** file is changed from ‚0‘ to ‚l‘, before the **EM20** PC-programme is started. For editing, use a text editor like Notepad. The **EM20.ini** file is located in the same directory as **EM20.exe.**

Calibration of the voltage and current is now run from the PC-programme (Menu **„Calibrate“ - „Voltage and current“).** The shown values are transferred from the EM20.
Offset for voltage and current measurements are adjusted by selecting **‚Measurement on frontpanel’,** shortcircuit the input bushings **(SUPPLY)** and selecting **‚Adjust offset‘.** A value for the offset is displayed on the screen.
Fullscale values are adjusted seperately for voltage and current on the frontpanel and the rearpanel. The new values are transferred to the ME20 by selecting **„Download“.**